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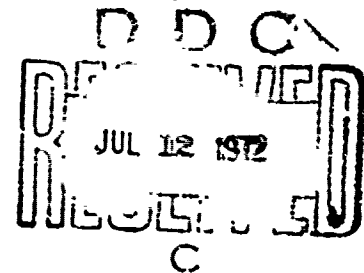
**ARMY MATERIEL COMMAND**  
**U.S. ARMY**  
**FOREIGN SCIENCE AND TECHNOLOGY CENTER**



**THE TECHNOLOGY OF DRYING WHITE ROOTS IN CUBES**

**BY**

**L. N. BUGROVA**



**COUNTRY: USSR**

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# TECHNICAL TRANSLATION

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The technology of drying white roots (parsley, celery, parsnips) cut into cubes was first worked out in an institute laboratory, and then at the Detchinskii Experimental Factory of vegetable concentrates.

In the laboratory, white roots were dried in cylindrical dryers with a speed of air movement 0.5 m/s and temperatures determined by technological instructions for drying white roots in strips. Temperature of this varies within limits 55-45°C.

First, the white parsley root is peeled and cut up into cubes with dimensions of the sides 6, 8 and 9 mm. The load for 1 m<sup>2</sup> of surface of the screen for the cubes of various dimensions is changed so that the process of drying remains constant.

During drying of the material size of the surface being dried is very important, especially during drying to a moisture content of 13-14%, when evaporation of the wetting moisture occurs, moisture of micro- and macro-capillaries. Therefore, along with determining a load for 1 m<sup>2</sup> of surface of the screen, we determined the specific surface of 100 grams of raw material of parsley root. At first, the load for 1 m<sup>2</sup> of surface of the screen was experimentally selected for cubes with dimensions of the face 6 mm. The optimal load for the screen was 16 kg/m<sup>2</sup>, during which the cubes of parsley root dried to moisture content 12.88% during 150 minutes.

The drying procedure of white roots in cubes of other dimensions is characterized by the following experimental data.

	Dimensions of cubes of parsley root, mm		
	6X6X6	8X8X8	9X9X9
Specific surface of 100 grams of cubes before drying, cm <sup>2</sup>	1077	860	731
Load per 1 m <sup>2</sup> of screen surface, kg/m <sup>2</sup>	16.0	12.3	10.5
Variation of relative moisture content of the air during drying, %	40.0	48-56.0	48-66.0
Moisture content of the dry product, %	12.88	13.0	13.33

The data presented show that the change in load of the product per 1 m<sup>2</sup> of screen surface depending on the dimension of the cubes has a direct relationship to the change in their specific surface.

On the basis of the data obtained when weighing the product in the process of drying curves were constructed which are presented in Figure 1, which show the uniform character of the course of the drying process (for cubes of varying dimensions).

For working out a process of drying the low moisture content (not more than 8%) white roots in cubes of various dimensions were dried in a single layer for a period of 5 hours with a relative moisture content of the air 32-40%. It was established that very large cubes (10 X 10 X 10 mm) for one cycle, dry to a moisture content of 6%, and very small small (6 X 6 X 6 mm)--- to 4.66%. The process of drying white roots in cubes in a single layer is presented in Figure 2.

In Figure 2 it is apparent that drying parsley root cut into cubes of various dimensions slows down significantly after about 180 minutes, and practically stops after 240 minutes. Thus, white roots in cubes with dimensions up to 10 mm actually dry to a low moisture content in 240 minutes in one cycle.

It is established that after 240 minutes drying white roots cut into cubes of dimensions 6 X 6 X 6, 8 X 8 X 8 and 9 X 9 X 9 mm, with a load for 1 m<sup>2</sup> of screen surface respectively equal to 16.0, 12.3 and 10.5 kg/m<sup>2</sup>, acquire a brittle consistency and dry to final moisture content [Numbers illegible on original text].

The drying procedures worked out in the laboratory were tested under factory conditions. The testing was done on celery and parsnip root crops. The small rootlets are cleaned off the roots ahead of time and then they are scraped. The roots are cut on a root cutter of type "Ritm" into cubes with dimensions 8 X 8 X 8 mm; 70% of the celery can be

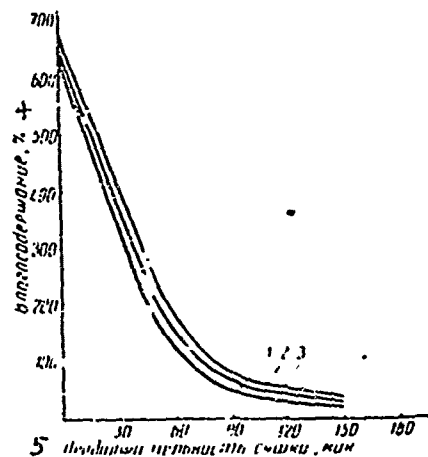


Figure 1. Drying curves to moisture content 13-14% of parsley root, cut in cubes of various dimensions: 1. 6 X 6 X 6 mm; 2. 8 X 8 X 8 mm; 3. 9 X 9 X 9 mm; 4. Moisture content, %; 5. Drying time, minutes.

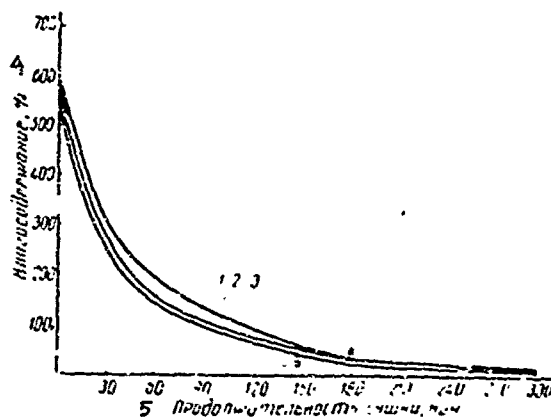


Figure 2. Curves of drying parsley root in a single layer to a moisture content of not more than 8%, cut in cubes of various dimensions: 1. 6 X 6 X 6 mm; 2. 8 X 8 X 8 mm; 3. 10 X 10 X 10 mm; 4. Moisture content, %; 5. Drying time, minutes.

obtained in the correct shapes, and 57.1% of the parsnips. The remaining part was pieces of incorrect shape.

White roots cut into cubes with dimensions of the face 8 mm, were dried on a PKS-20 dryer equipped with an exhaust fan. Drying of these roots was done according to the following procedure:

	To moisture content 13-14%	To moisture content not more than 8%
Load on the first tape, kg/m <sup>2</sup>	12.3	8.0
Load of the product in one minute, kg	2.0	1.3
Speed of movement of the tape, m/min		
First . . . . .	0.13	0.13
Second . . . . .	0.095	0.095
Third . . . . .	0.075	0.075
Fourth . . . . .	0.055	0.055
Air temperature of the tape, °C		
First . . . . .	48-50	48-50
Second . . . . .	55	55
Third . . . . .	50	50
Fourth . . . . .	40	40
Final moisture content of the product, %	13	6.0
Quantity of air circulating through the dryer, m <sup>3</sup> /hr	5000	5000

For drying white roots to a moisture content of not more than 14% under industrial conditions 248 minutes was required, the same time in the laboratory was only 150 minutes.

For drying white roots to a low moisture content the load on 1 m<sup>2</sup> of screen surface was decreased to 8 kg/m<sup>2</sup>. Certain changes in the drying procedure of white roots (in comparison with laboratory studies) are explained by lower drying temperatures for the first and fourth tapes, which do not have a specific supply of steam as when drying in a cylindrical dryer, and also decreased speed of air movement, equal to 0.27 m/s.

Dried white roots in cubes with dimensions 8 X 8 X 8 mm done by this process have a crunchy consistency and yellow color. These indices are characterized by the following data:



Moisture content, % . . . . .	13	6
bulk mass, g/cm <sup>3</sup> . . . . .	0.30	0.255
Coefficient of swelling ability . . . . .	3.98	4.05
length of time of cooking to a pulp, min . . . .	13.0	16.0

Loss of essential oil: in the process of drying to a moisture content of 13% consisted of 20%, and when drying to a low content (6%) of moisture--- 33-40%.